What is claimed is:

1. A method for designing an unequal error protection block code comprising;

selecting a first linear block code,

generating a subcode of the block code,

generating a second block code by concatenating the first linear block code with the sum of itself and the subcode,

generating a generator matrix for said second block code, and

decomposing the generator matrix to include empty submatrices.

2. The method of Claim 1 further comprising;

generating a subcode of the second block code,

generating a third block code by concatenating the second linear block code with the sum of itself and the subcode of the second block code,

generating a generator matrix for said third block code, and

decomposing the generator matrix for said third block code to include empty submatrices.

3. The method of Claim 1 wherein:

said first linear block code is a Reed-Muller code.

4. The method of Claim 1 wherein:

said first linear block code has a generator matrix G,

said subcode has a generator matrix G_1, and

said step of decomposing comprises generating a code comprising the set of representatives of the cosets of said subcode in said first linear block code and having a generator matrix G_3.

5. The method of Claim 4 wherein:

$$[G] = \begin{matrix} [G_3] \\ [G_1]. \end{matrix}$$

6. The method of Claim 5 wherein:

said second block code has a generator matrix G2 and

$$[G_2] = \begin{matrix} [G \;\; G] \\ [0 \;\; G_1] \end{matrix}$$

and is decomposed by rewriting as

$$[G_2] = \begin{matrix} [G_3 \; G_3] \\ [G_1 \; G_1] \\ [0 \;\; G_1] \end{matrix}$$

and then subtracting the last row of submatrices from the second row of submatrices to provide a decomposition of G_2 having two empty submatrices as follows

$$[G_2] = \begin{matrix} [G_3 \; G_3] \\ [G_1 \; 0\,] \\ [0 \;\; G_1]. \end{matrix}$$

7. A digital communications system comprising:

an encoder configured to receive a digital signal and convert said digital signal to a digital codeword,

said encoder including an error protection code generator matrix having the form:

$$[\, G_3 \;\; G_3]$$

$$\begin{bmatrix} G_1 & 0 \\ 0 & G_1 \end{bmatrix}$$

wherein G_1 is a generator matrix for a subcode C_1 of a block code C and G_3 is a generator matrix for the set of representatives of the cosets of C_1 in C.

8. The digital communications system of Claim 7 wherein:

said block code C is a Reed-Muller code.

9. The system according to Claim 7 further comprising:

a means for sending said code words through a transmission channel.

10. The system according to Claim 9 further comprising;

means coupled to said transmission channel for receiving said code words,

means for dividing received code words into a plurality of sections, and

means for simultaneously decoding each code word section.

11. The system according to Claim 10 wherein:

$[G_3]$ has k_3 rows and n columns,

$[G_1]$ has k_1 rows and n columns,

the digital signal has a length of k_3 plus two times k_1 and is subdivided into three parts d_a, d_b and d_c having lengths of k_3, k_1, and k_1 respectively,

the codeword has a length of 2n, and is divided into a left half and a right half,

further comprising;

2^{k_3} decoding sections, each section assuming one of the 2^{k_3} possible values of d_a and each section including a right half and left half decoding unit and an adder,

each left half decoding unit selecting the value of d_b which provides the minimum squared Euclidian distance between the received codeword left half and code words corresponding to the assumed value of d_a and all possible values of d_b,

each right half decoding unit selecting the value of d_c which provides the minimum squared Euclidian distance between the received codeword right half and code words corresponding to the assumed value of d_a and all possible values of d_c,

each adder summing the minimum squared Euclidian distances provided by the left half and right half decoder units of its section,

a comparator coupled to all of said adders selecting the minimum output of all adders as identifying the correct code word corresponding to the received code word.

12. An error protection code generator matrix having the form:

$$\begin{bmatrix} G_3 & G_3 \end{bmatrix}$$
$$\begin{bmatrix} G_1 & 0 \end{bmatrix}$$
$$\begin{bmatrix} 0 & G_1 \end{bmatrix}$$

wherein G_1 is a generator matrix for a subcode C_1 of a block code C and G_3 is a generator matrix for the set of representatives of the cosets of C_1 in C.

13. The error protection code generator matrix of Claim 12 wherein:

the block code C has a generator matrix G and

$$[G] = [G_3]$$
$$[G_1].$$

14. A method for communicating digital signals with error protection comprising:

selecting a first linear block code,

generating a subcode of the block code,

generating a second block code by concatenating the first linear block code with the sum of itself and the subcode,

generating a generator matrix for said second block code,

decomposing the generator matrix to include empty submatrices, and

encoding a digital data word with said generator matrix including empty submatrices to produce a code word.

15. A method according to Claim 14 further including:

dividing said code word into a right half and a left half and simultaneously decoding each half.

16. A method according to Claim 14 wherein:

said generator matrix including empty submatrices has k_3 plus two times k_1 rows and n columns,

said data word has a length of k_3 plus two times k_1 and is subdivided into three parts d_a, d_b and d_c having lengths of k_3, k_1, and k_1 respectively,

said codeword has a length of 2n, and is divided into a left half and a right half,

further comprising the steps of,

for each of the 2^{k_3} values of d_a, selecting the value of d_b which provides the minimum squared Euclidian distance between the received codeword left half

and code words corresponding to the assumed value of d_a and all possible values of d_b,

for each of the 2^{k_3} values of d_a, selecting the value of d_c which provides the minimum squared Euclidian distance between the received codeword right half and code words corresponding to the assumed value of d_a and all possible values of d_c, and

for each of the 2^{k_3} values of d_a, summing the minimum squared Euclidian distances for the selected values of d_b and d_c and selecting values of d_a, d_b and d_c which correspond to the minimum sum as the correct data word for the code word.

17. A method for communicating digital signals with error protection comprising:

decoding a codeword having a length of 2n which has been generated by encoding a data word comprising three parts d_a, d_b and d_c having lengths of k_3, k_1, and k_1, respectively, with a generator matrix including empty submatrices and having k_3 plus two times k_1 rows and n columns by the steps of;

for each of the 2^{k_3} values of d_a, selecting the value of d_b which provides the minimum squared Euclidian distance between the received codeword left half and code words corresponding to the assumed value of d_a and all possible values of d_b,

for each of the 2^{k_3} values of d_a, selecting the value of d_c which provides the minimum squared Euclidian distance between the received codeword right

half and code words corresponding to the assumed value of d_a and all possible values of d_c, and

for each of the 2^{k_3} values of d_a, summing the minimum squared Euclidian distances for the selected values of d_b and d_c and selecting values of d_a, d_b and d_c which correspond to the minimum sum as the correct data word for the code word.

18. A method according to Claim 17 wherein:

said generator matrix is generated by the steps of

selecting a first linear block code,

generating a subcode of the block code,

generating a second block code by concatenating the first linear block code with the sum of itself and the subcode,

generating a generator matrix for said second block code, and decomposing the generator matrix to include empty submatrices.

19. A method according to Claim 18 wherein:

said first linear block code is a Reed-Muller code.

20. A method according to Claim 17 wherein said matrix has the form:

$$\begin{bmatrix} G_3 & G_3 \\ G_1 & 0 \\ 0 & G_1 \end{bmatrix}$$

wherein G_1 is a generator matrix for a subcode C_1 of a block code C and G_3 is a generator matrix for the set of representatives of the cosets of C_1 in C.